Description

LOW PRESSURE VALVE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. patent application Ser. No. 10/138,282 filed May 3, 2002 which claims priority from U.S. provisional application no. 60/289,705 filed May 8, 2001.

TECHNICAL FIELD

The present invention relates to low-pressure valves.

BACKGROUND OF THE INVENTION

All references included herein are incorporated by reference. Low-pressure valves are useful for a range of applications. In many instances a container, such as a flask, keg, barrel, etc, containing a liquid, may need gasses to vent without allowing air to enter. Such a vent allows gasses to escape the container without introducing possible contaminants into the container. One example of this is in wine production. Wine is fermented in barrels where introduced yeast converts sugar from grapes into alcohol and carbon dioxide. The carbon dioxide is vented from the barrels to prevent the gas from redissolving in the fermenting wine, resulting in carbonation.

Presently a number of devices are used as low pressure vents to release gas from fermenting wine. Although these devices are rather varied, they do share some similarities. Many of these devices are designed having a cork shaped tapering cylindrical body. In this way the stopper may be fit into a variety of holes. These devices are typically made of a resilient polymeric

material, allowing further elasticity. These devices typically have some passageway from the bottom to the top of the stopper allowing gas to pass from the liquid to vent into outside air. Typically a second piece covers or impedes the passageway. This second piece is attached such that low gas pressure allows this piece to be displaced slightly, venting gas from within the container to the outside air. The resilient second piece then conforms back to its original position. Examples of such devices include anchored stoppers, passageways covered by secondary flaps, or balls retained by an annular lip within a stopper passageway. Such devices may be seen in U.S. Pat. Nos. 5,947,326 and 5,702,018.

These devices share some common shortcomings. The tapered cylinder design does allow the venting stopper to be used in a variety of openings. However, the profile of the stopper will differ depending on the size of the hole. If the hole is too large, the stopper will seat too low in a barrel. This will make the stopper difficult to remove. Attempts to pry out a stopper that has sunk too far into a hole could result in damage to a barrel as well as costing workers time. Given that wine aging barrels are quite expensive, damage to barrels can become a significant cost. If the hole is too small, the stopper will seat too high on the barrel. This will cause a portion of the stopper to stick up from the side of the barrel. This increases the risk of the stopper being accidentally knocked loose (e.g. by a forklift moving barrels).

In addition to this drawback, the common two-piece stopper is difficult to clean. The different parts of the stopper must be sterilized. Getting these pieces sterilized requires some manipulation of the stopper to ensure all parts of the stopper valve are clean.

In addition, these valves may be difficult to insert and remove. The present valves are press fit or pounded into the casks. This fit may be quite tight, requiring additional time and effort to remove the stopper without damaging the wine barrel.

It is an object of this invention to provide a low-pressure gas relief valve that may be inserted in holes of slightly varying sizes and still have a uniform profile in relation to the hole.

It is a further object of the invention to provide a low-pressure gas relief valve which is simple to clean and easy to insert and remove.

It is a further object of the invention to provide a low-pressure gas relief valve that is simple in design and uses less material than conventional gas relief valve stoppers.

SUMMARY OF THE INVENTION

The above objects have been achieved with a simplified, one-piece gas relief valve. The valve has a cup-shaped body with a floor at the bottom of the body and an annular flange at the top. Preferably the annular flange is somewhat concave and arcs toward the bottom of the stopper, creating a low, rounded flap. This flap may be used both to vent gas (which is released from under the flap as the gas pressure builds) and as a pull-tab to easily remove the stopper from holes. In addition, the shape adds tension, holding the flange against a surface. As with other stoppers, this stopper is made from a resilient polymeric material. One or more grooves extend from near the bottom of the exterior of the body to near the top, sufficient such that gas may move from inside of the barrel to the top of the flange. Preferably, multiple side grooves are used. This both allows efficient gas release but also allows for greater

elasticity of the cup-shaped body, allowing the stopper to compress somewhat to fit into different sized holes. The cup shape may be somewhat tapered to enhance this effect. In addition, the bottom of the part may be slightly thicker than the cup top near the rim, allowing for a snug, secure fit. In one embodiment, the cup has a plurality of grooves. Between each groove on the inner side of the flange is a slight lip. This lip has a lower height than the curvature of the flange toward the barrel (or bottom of the stopper). This lip fits against the edge of the barrel hole and ensures that the gas exiting from the barrel is not blocked. This acts as a physical limit to the depth the stopper may be inserted, insuring that the stopper is never inserted so far that the gas path is blocked.

The flange when inserted into a barrel fits snuggly against the surface of the barrel. The flange has a very low profile, which is uniform for any hole in which the stopper is inserted. Gas may move up the body in the groove, and will flow out of the annular flange when the gas pressure is sufficient.

This one-piece low-pressure valve has no through holes; therefore, allowing for easy cleaning.

This valve may be inserted by hand and removed without tools.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a bottom view of the valve, with a dashed line to indicate wall thickness.

Fig. 2 is a side cutaway view of the present valve of Fig. 1.

Fig. 3A is a cross-sectional view of the present valve inserted into a barrel.

Fig. 3B is the view of Fig. 3A with a cap piece affixed onto the open top.

Fig. 4. is a rotated cross-sectional view of the valve of Fig. 1 inserted into a barrel.

Fig. 5 is a perspective of the present valve inserted into a barrel.

DETAILED DESCRIPTION OF THE INVENTION

This invention has been primarily described for use with wine barrels. However, it is easily adaptable for use in other applications, such as cell culture, commercial fermentation, beer brewing, steam venting, etc. in which low pressure gas (e.g. gas under 3 psi) may need to be vented from a container. The stopper could be placed over a hole in the container, allowing the gas inside the container to vent.

In reference to Fig. 1, the present valve 10 is a one-piece valve made of a resilient material. Valve 10 includes resilient flange 16, which extends from the cup-shaped body of the valve. Extending from the closed bottom 12 of the cup-shaped body are flutes 24. A single flute would be sufficient to vent gas. For other applications, 4-8 symmetrical grooves running from the bottom of the valve body to the top could be used. Extending between flutes 24 is lip 18, which forms part of flange 16.

In Fig. 2, valve 10 in cross section shows that side walls 11 and bottom 12 form the cup-shaped valve body. This has a closed bottom end and an open top end 14. Extending from rim 22 at the top of the valve is flange 16. The bottom outer edge 20 of flange 16 is angled such that the flange seats flat against a container surface as opposed to catching on container surface when the valve is inserted into a container hole. Lip 18 acts as a stop to limit the insertion depth of the valve into a hole. This prevents the flange from sealing to the surface of a container when the valve is inserted

into a hole. Side flutes 24 allow a low-pressure gas to move from the bottom of the valve to the area below flange 16.

In Figs. 3 and 4 a cross sectional view of the valve inserted into an opening in a cask is illustrated. The two cross sections illustrate the cross section at the location of a flute (Fig. 4) and the cross section at the location having no flute (Fig. 3A). In Fig. 4, flange 16 is held biased against cask 30 when valve 10 is inserted into an opening in the cask. Gas at a low pressure may travel from the cask interior up flute 24 and out from under flange 16. Closed valve bottom 12 prevents gas from escaping through the valve. This will occur at each of the various flutes of the valve. In Fig. 3, the lip 18 is held against the cask surface 30. The height of lip 18 will prevent insertion of the valve 10 too far into the hole in the cask. Flange 16 is thus prevented from being completely flat against the surface of cask 30. A perspective of valve 10 inserted into a hole in cask 30 with flange 16 extending about the rim of the hole is shown in Fig. 5.

Unlike some other valves, this valve is not subject to "sticking", which could occur when parts of a two-part valve are in contact. The pressure needed to move a two-part valve in an initial release of gas may be higher due to frictional forces between the pieces or material attraction. In the present valve, greater consistency of pressure release is expected. Selection of materials or valve body/flange thickness could allow for greater or lesser material resistance, allowing greater or lesser pressure requirements for gas release.

The valve may be made of silicone rubber or other resilient material. If the application requires that the valve prevent the passage of light, a dye may be

added to the polymeric resilient material such that it is not translucent.

In Fig. 3B the valve is shown with a cap 50 covering the open top of the valve. Cap 50 has side flanges 54 extending over valve flange 16. Side walls 52 extend downward into the body of the valve, securing the valve firmly in place. This cap may have one or more (e.g. 8) side flutes to allow compressibility, making the cap faster to insert. Use of the cap could prevent dust or water from gathering in the body of the valve.